

Integration of Dynamic Data into Characterization of the Tengiz Reservoir: Tengiz Slope

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The Tengiz reservoir, located on eastern shore of the Caspian Sea in the Republic of Kazakhstan, is an isolated carbonate buildup with a mesa-like geometry containing a flat topped platform and steep slope. The platform is relatively unfractured, while the slope, largely made up of boundstones, is significantly fractured.

Proper fracture characterization and a good understanding of the fracture-matrix system are critical to properly predict oil recovery from naturally fractured reservoirs.

Wellbore-fracture data is constrained through a combination of both static and dynamic data, such as image logs, Stoneley-reflectivity, photoelectric curve (PEF), caliper logs, and PLT spikes, and lost circulation data respectively. PTT data has allowed us to confirm dual-porosity pressure transient behavior and has been a critical dataset to help constrain estimates of fracture porosity, fracture density, and the matrix-fracture transfer function. Pulse tests provide insights into the connectivity of the fracture system between the wells and between field regions.

Observation of the pulse test data shows different types of heterogeneity in Tengiz with very high connectivity over long distances in slope and poor communication between platform and slope.

Review of the historical static pressure data indicated that there are several distinct pressure regions within the Tengiz Field. The low transmissibility boundaries between these regions are very consistent with the pulse test results indicating very low diffusivity.

Observation of MDT and static pressure data indicates passive depletion of Unit 2/3 platform by connection to Unit 1 production through the Unit 2/3 Slope fracture network. In addition, pressure monitoring of distal wells also showed passive depletion which suggests that Tengiz acts as a single reservoir over geologic time with all units in pressure communication.

The topic of this discussion will be the role of the fractures in the reservoir management and on-going reservoir & fracture characterization efforts (through data integration of the previously mentioned data sources) in building of more realistic simulation model. This work will discuss the role of integrating static, dynamic, and engineering data to properly characterize the Tengiz field.

We will illustrate how various static and dynamic data will be incorporated into the P10 P50 P90 model.

Lessons Learned

- The large variety of independent source data and multi-disciplinary teamwork improved the characterization and modeling of the reservoir.

Best Practices Adopted and Share

- The Use of different static and dynamic data in combination improved reservoir characterization and helped in building realistic simulation model
- A fit-for-purpose monitoring model with nested grid refinement is developed to properly incorporate scale-dependant dynamic reservoir data.

Challenges that you faced on the Project.

- Limitation of technology and techniques does not allow to directly incorporate dynamic data into the model.
- Due to the large grid size of the geologic model & simulation model (250m x 250m) certain dynamic data (RST, tracer, Pulse test) cannot be input directly into the full-field models because of scale differences between the data and grid system.
- Integration of all data sources improved the teams understanding of the complex nature of the reservoir architecture.